

# The Petroleum Sector in Lebanon: History, Opportunities and Challenges

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## **Abstract**

The paper presents a brief overview of Lebanon's fledgling petroleum industry, the opportunities it brings to Lebanon, the challenges it presents, and the way forward. The discovery of hydrocarbon in the Lebanese offshore can be placed under the double title of attraction of considerable foreign investments and jobs creation to operations, processing and down streaming of the petrochemical industry. The paper is divided into six sections: the history of exploration in Lebanon, the current status, opportunities during exploration and production, opportunities with petrochemical and downstream industries, and challenges ahead. It concludes with a set of recommendations for Lebanon can to take full benefit of this industry.

**Keywords:** Lebanon – Petroleum Exploration in Lebanon – Exploration and Production – Petrochemical industries – Investments – Opportunities and Challenges – Recommendations – Lebanese Petroleum Administration in Lebanon

## 1. **History**

Petroleum exploration has a long history in Lebanon. It started in the thirties of the last century when the French Mandate took the decision to legislate petroleum exploration. From that time until the seventies, several wells have been carried out in the Lebanese onshore. Some of them have been drilled up to 3000 m depth without actually finding oil. However, a contemporary reading of geological description of layers that are drilled through and of comments done by site geologists having supervised drilling operations might suggest the presence of methane and heavy hydrocarbon. At that time, investors had no interest in gas and production and processing operations of heavy hydrocarbon were very expensive. Exploration activities came to a standstill as a result of adverse security conditions due to the civil war of the seventies.

In the nineties, reconnaissance for petroleum purpose has restarted in offshore area. Geophysical reconnaissance has been intensified to cover, in 2013, all the Lebanese Exclusive Economic Zone EEZ-, commonly called Lebanese Offshore which encompasses around 22000 km<sup>2</sup>, with

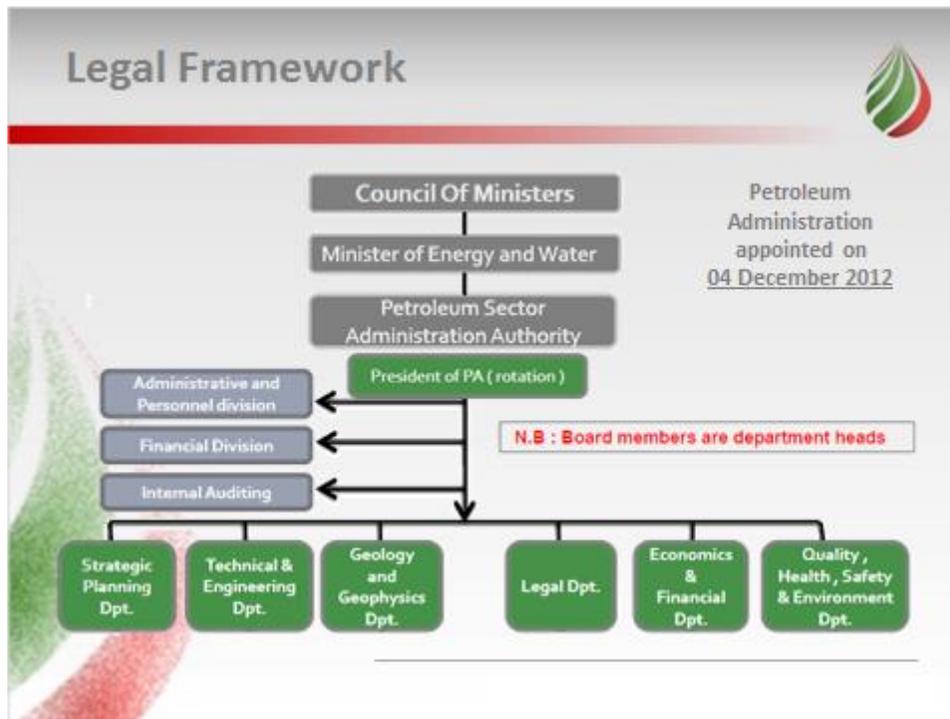
2D seismic survey and 70% with 3D seismic survey. Interpretation of these surveys done by the Lebanese Petroleum Authority suggests that Lebanese offshore is a Gas promoting province. This is corroborated with the findings of studies and researches of high credibility conducted by world-class research centers and Gas discoveries in the adjacent offshores. The US Geological Survey estimates a mean of 122 tcf (trillions cubic feet) of recoverable gas in the Levant basin province that covers Lebanese, Palestinian and part of Cyprus offshore. Nevertheless, we must be extremely careful when referring to estimate since we haven't yet drilled any wells in the Lebanese offshore.

This doesn't hinder the LPA to set a vision for the development of Petroleum industry in Lebanon. This vision will be developed more to become a strategy once proven reserves are assessed based on wells data which can only be obtained once drilling operations are carried out in the Lebanese Offshore.

## 2. Current status

To develop upstream industry, the legislator has modernized the outdated legal framework through the law 132 of 24/8/2010 dedicated to petroleum activities in the EEZ. A number of implementation decrees have been issued to properly enforce legislation. In this sense, the Lebanese Petroleum Administration LPA has been established.

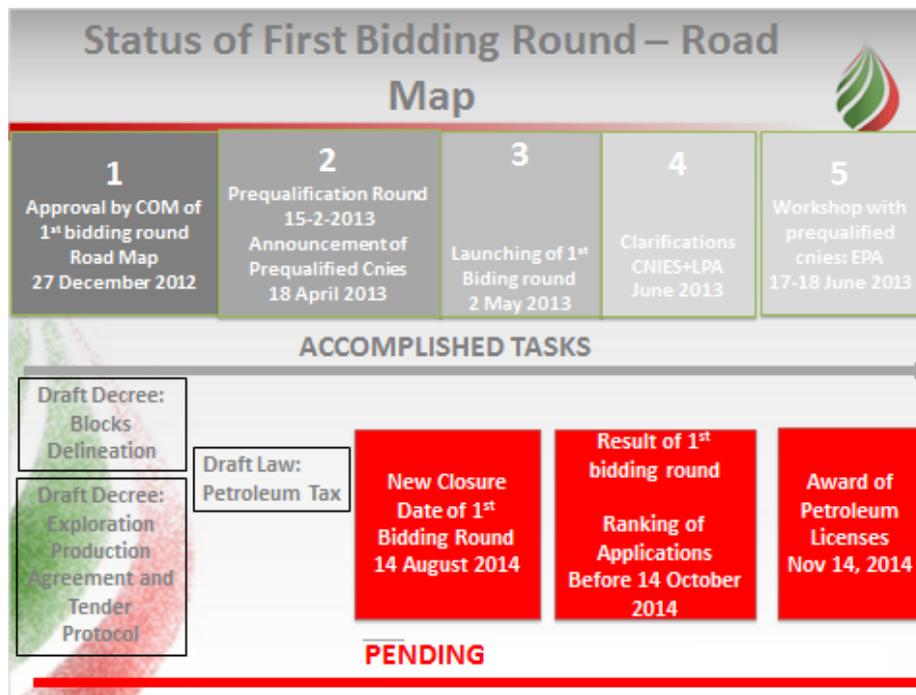
(Figure 1) Legal Framework



Source: Lebanese Petroleum Administration

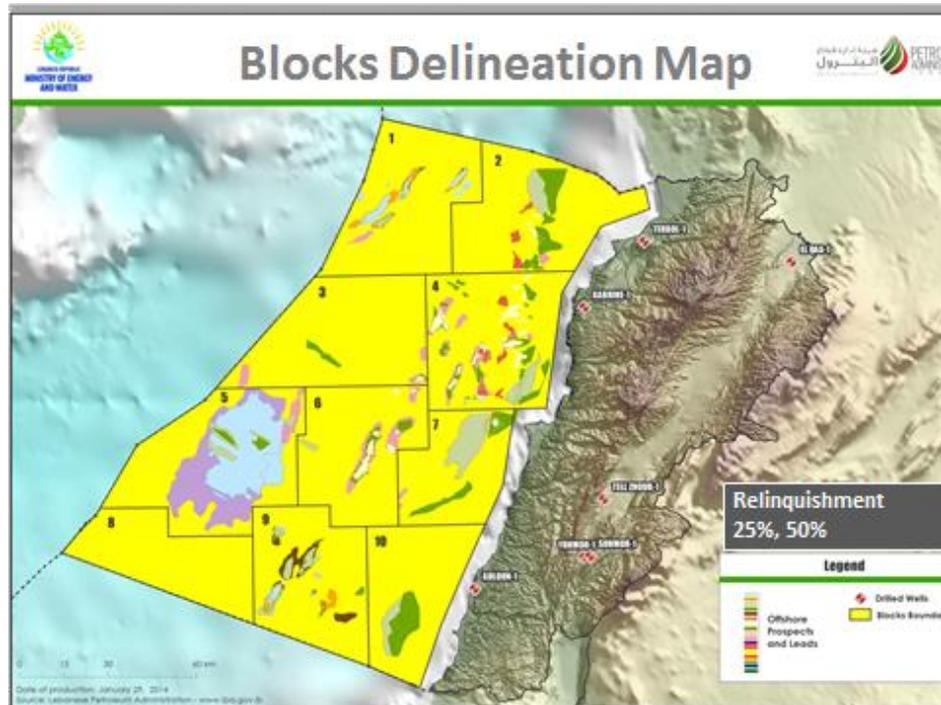
Promptly after it is constituted, the LPA started to prepare the first bidding round that aims to auction part of the EEZ for exploration and production. In this regard, 46 international companies among them 12 operators have been prequalified to take part of the first bidding round. The prequalification process was transparent and fully complying with the international standards. In meanwhile, the draft of two decrees regarding blocks delineation and the draft of EPA – Exploration & Production Agreement- that manages the relationship between Lebanon and petroleum companies has been issued. Their ratification by the council of ministers is still pending. Once ratified, the LPA will give 3 months to petroleum companies to prepare and submit their applications, the review of which by the LPA experts will take 6 weeks. 1 month later, the EPA can be signed in Beirut. As Lebanon has 3D seismic survey, drilling vessel can be seen in the Lebanese offshore ~ 6 months after the signature of the EPA. Off course, “shimmering” dreams to Lebanese citizens is literally immoral. Nevertheless, even we don’t have yet any accurate and robust figure about petroleum recovery in our Offshore, it is reasonable and essential to anticipate and prepare the ground for the development of Petroleum industry in Lebanon. If the first exploration well is successful, then what will be the following steps and the consequences of Petroleum discovery?

(Figure 2) Status of First Bidding Round – Road Map



Source: Lebanese Petroleum Administration

(Figure 3) Blocks Delineation Map



Source: Lebanese Petroleum Administration

### (Box 1) Exploration and Production Agreement

The Exploration and Production Agreement (EPA) is a contract between the State and international or Lebanese oil companies, providing the companies with the right to explore for, develop and produce oil and gas reservoirs offshore in Lebanon's Exclusive Economic Zone. It will be awarded to companies in a competitive bidding process, pursuant to the Offshore Petroleum Resources Law (OPR Law) and the Petroleum Activities Regulation (PAR). Once the companies sign the EPA, they are required to comply with all of the requirements of the OPR Law and the PAR, as well as all other Lebanese laws.

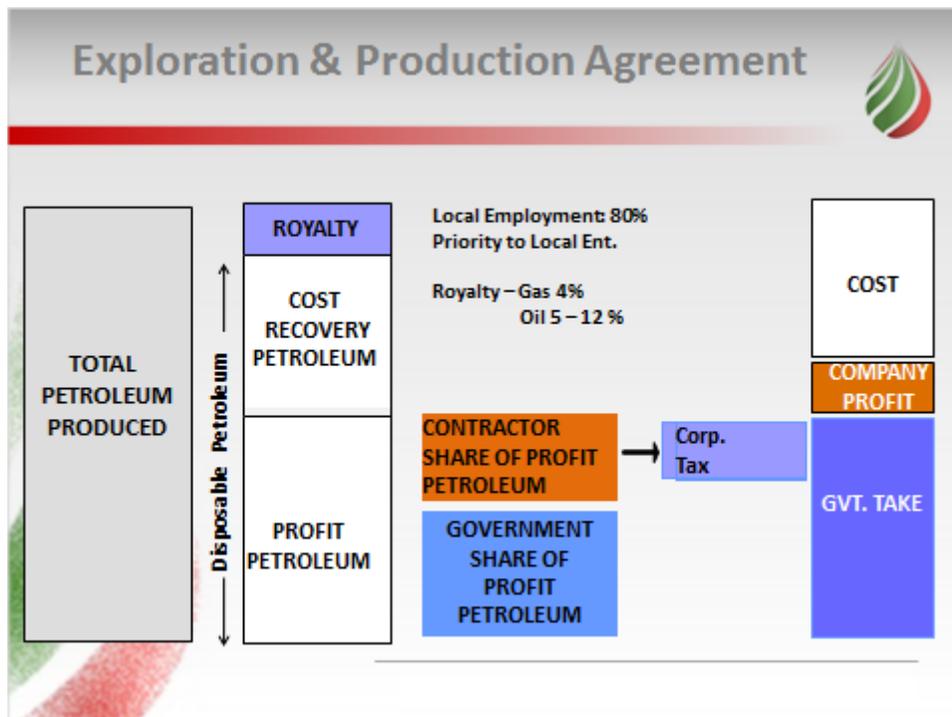
The companies that sign the EPA are called Right Holders, and there must be three of them at all times. One of them is the Operator, responsible for carrying out day-to-day activities, although all Right Holders are jointly and severally liable for their obligations. Under the EPA, the Right Holders may explore for oil and gas during a five year Exploration Phase, divided into two periods of three years and two years (it can be extended up to 10 years with the approval of the Council of Ministers). If the Right Holders discover oil or gas, they must appraise the commercial potential of the discovery, and if they conclude it is commercial, they must propose

a plan to develop the discovery and produce oil and gas. That plan is subject to approval by the Council of Ministers. If approval is granted, the Right Holders must produce oil and gas during a twenty-five year Production Phase, which can be extended by five years if the Right Holders agree to make additional investments.

The oil and gas is split between the Right Holders and the State, as follows. First, the Right Holders must pay Royalties to the State, equal to 4% of the gas produced, and a varying percentage (between 5% and 12%) of the oil produced. Second, a percentage (determined by bidding) of the oil and gas is allocated to the Right Holders to reimburse their costs. The remaining oil and gas is split between the State and the Right Holders in proportions determined by bidding under a formula pursuant to which the State’s share increases after the Right Holders have recovered their investment. Right Holders also must pay all Lebanese taxes.

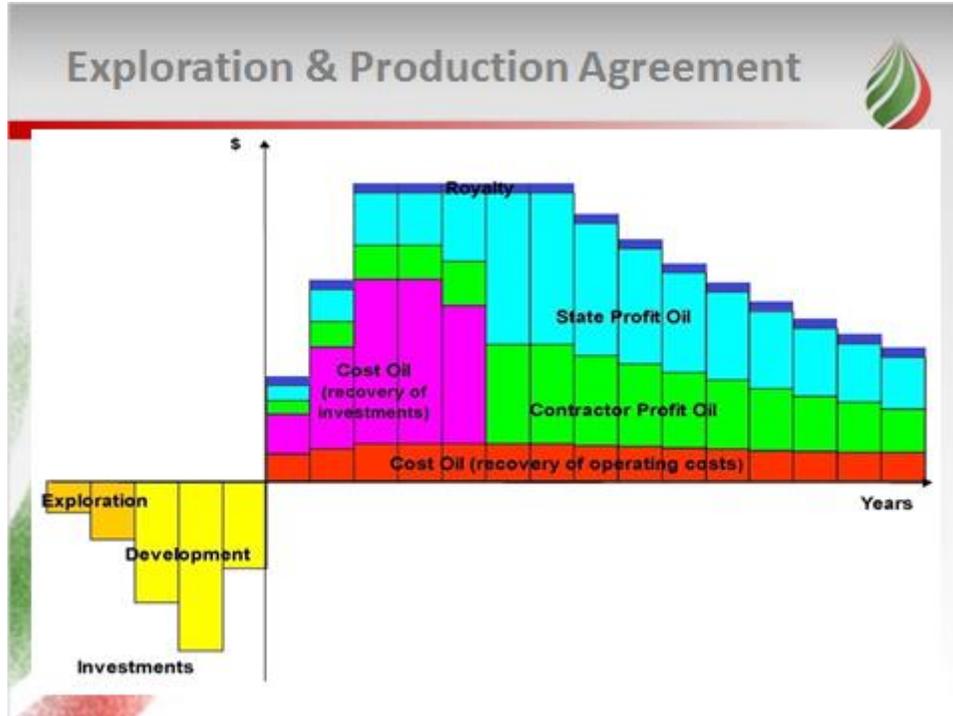
The EPA requires the Right Holders to conduct operations in accordance with Best International Petroleum Industry Standards, to safeguard health, safety and the environment and remedy any accidents, and to pay cash into a fund to ensure that facilities are properly dismantled after the reservoir is depleted. The Right Holders must give preference to Lebanese goods and services in awarding contracts, and at least 80% of the employees must be Lebanese nationals. A mandatory training program is required, to ensure that Lebanese nationals will occupy management, engineering and other professional positions.

**(Figure 4) Exploration and Production Agreement**



Source: Lebanese Petroleum Administration

(Figure 5) Exploration and Production Agreement



Source: Lebanese Petroleum Administration

### 3. Opportunities with Exploration and Production

Exploration phase comprises 2 subphases: - exploration strictly speaking which involves exploration wells drillings to confirm the presence of hydrocarbon and – appraisal that involves wells for tests and experiments to define the extent of reservoirs, its boundaries, characteristics and the proven recovery. Exploration phase will extend over a period of 6 years. Then starts the Production phase will last for 25 years including encompassing field development activities, facilities construction and production strictly speaking. Of course, the petroleum profit will be collected by the government from the start of production. This does not mean that there is no benefit during exploration phase. One of the main distinctive features of the offshore upstream industry is the high level of investment that can be made in the country which will bring cash and create jobs from the beginning of exploration activities. For their operations in the Lebanese Offshore, petroleum companies will invest time and money to achieve their strategic objective which is exploring, developing, producing and selling hydrocarbons. Such investments will help to create local SME and to generate jobs either for operations led by companies that shall hire more than 80% of Lebanese in their staff or through SME created in Lebanon.

An exploration well in deep offshore costs 120 MUS\$ to 180 MUS\$. Several wells can be planned to be drilled in awarded block. Associated activities embrace drilling, casing, cementing, cementing, logistics, sea and air transport, catering and other services. 80% of 100 to 200 jobs created per well shall be done by Lebanese technicians and engineers as stated in the EPA. EPA. Lebanese SME can benefit from at least 50 % of money invested. Investments for appraisal appraisal will grow to reach several hundred of MUS\$ owing to the increase of the number of wells to be drilled and the complexity of technics applied to conduct tests and experiments. Here Here also, half of money invested will be collected by Lebanese SME and several hundred of jobs can be created. Investment linked to subsea field development and the construction of above above sea process facilities will be considerable to reach several billion US\$ encompassing engineering, drilling of several production wells, installation of seafloor pipes, construction of of complex facilities for storage, transport and processing. Around 50 to 60% of this money can can be collected by Lebanese engineering firms, Lebanese construction enterprises and services services SME. In parallel, several thousands of jobs for technicians and engineers can be created. created. Once, the construction of facilities is achieved, production will begin, the number of jobs created will decrease to several hundred only to take in charge production operations. But But the government starts collecting petroleum profit part of it will be flowed to sovereign wealth fund structure of which is not yet defined. Briefly speaking, the development of petroleum fields will bring considerable investment and create hundreds of jobs but for a limited limited period of time of 3 to 5 years. Despite this limited profit, new trades will be created and and Lebanese citizens and SME involved in exploration activities will be able to export their expertise to regional market and south Europe.

On the other hand, upstream industry will open the path to place Lebanon on the global map of scientific research in geosciences, modeling, chemistry and economy.

#### **4. Opportunities with Petrochemical and downstream industries**

How maximizing the revenues without relying on the wealth fund only? The answer is in developing the gas domestic market. Switching energy production from fuel to gas will save 1,5 to 2,0 BUS\$ per year. Developing petrochemical industry and high consuming energy industry will enable to create thousands of permanent jobs for more than 20 years. A qualitative study about the industries that can be developed in Lebanon has been conducted. The quantitative and feasibility studies shall conducted promptly after carrying out exploration activities to have more accurate pictures of the impact of petrochemical and downstream industries. The industries that can be developed are: LNG (liquefied natural Gas), GTL (gas to liquid), Power Plants, Methanol, ethylene, fertilizers/Urea, Aluminum, etc ...

LNG is highly important for gas offshore gas development. Once contract is signed, the market is guaranteed for more than 20 year.

GTL reduces the dependence on refined petroleum products with high potential for regional market export and it constitutes an anchor load for the development of other activities mainly for transporting the GTL: pipes, tankers, harbors.

Power plants: Electricity Authority in Lebanon plans to develop gas power plants for domestic market. However, extending the development of power plants for regional market might constitute an opportunity with high potentiality.

Methanol and ethylene are used to produce plastic, solvent and acetic acid for local and regional market. For example, the global growth of plastic consumption is expected to be at a steady 5% for the years to come. The ethylene production is 5 times more expensive in Western Europe and South Asia than in Gas producing countries. There are opportunities to export to regional and south Europe markets.

Ammonia and urea: high potentiality for regional export. Development of urea plants lead to the development of other important development such as piping and transport.

In term of employment a major factor linked to gas consumption governs the number and the nature of jobs created that are categorized into annual average direct and indirect employment , long term direct and direct employment and long term induced employment. Based on assumptions from new gas producing developing countries, following estimates are given:

Employment by Project: Managerial 25%, Technical and Engineer 40%, General Labor: 35%

	Methanol/ Ethylene	LNG	GTL	Fertilizer	Aluminum w/power
Gas consumption (MMcfd)	16	225	130	15	60
Land use (Hectares)	20	200	20		200
Average Long term direct and direct employment	100	450	500	80	300
Average Long term induced employment	2000	4000	4000	1000	2000

The Increase of plants capacities and daily gas consumption will increase the employment by project.

## 5. Challenges

To guarantee an efficient development of upstream and petrochemical industries, Lebanon has facing numerous challenges encompassing land use concerns as Lebanon is highly urbanized, infrastructures, and education. A significant amount of infrastructure is to be developed:

- Offshore Gas production: Port facilities for service ships, service ships, equipment warehousing and storage yards, food and consumables storage and preparation, helicopter landing facilities, onshore worker housing and medical facilities
- Onshore Gas processing facilities, LNG export terminal: Land sites: piping, water sources, roads, equipment warehousing and storage yards, consumables storage, port facilities for receiving overseas equipment and materials and for export, power supply and transmission, tankage for storage, regasification facilities, sanitation and waste disposal systems, worker housing, food facilities, recreation facilities, medical facilities, helipad.
- GTL, fertilizers: Land sites , piping, water sources, roads, tankage for storage, warehousing, port facilities for receiving overseas equipment and materials and exports, waste disposal, worker housing, food facilities, recreation facilities, medical facilities, helipad.
- Pipelines for gas: cleared land right of way, access roads, land for compressors stations, power supply and transmission, equipment warehousing and storage yards, pipe storage, monitoring systems

As showed in the table presented above, 70% of employment shall be technician, managers or engineers. Creation of thousands of jobs either with upstream industry or petrochemical industry require skilled workforce. Public and Private universities are able to provide engineers needed to develop and operate. However, finding skilled technicians is a real challenge that calls for an intensification of public and private investment to provide the sufficient number of skilled technicians on time to maximize the benefit of the whole society from petroleum industry.

The development of upstream and downstream industries necessitate lands of several hectares can vary from 20 hectares for a methanol plant to 150 hectares for LNG train and 250 hectares for an aluminum plant.

## 6. Conclusion

The discovery of hydrocarbon in the Lebanese offshore can be placed under the double title of attraction of considerable foreign investments and jobs creation from the start of exploration activities to operations and processing and downstream/ petrochemical industry. To take benefit of this industry, it is highly recommended to:

- Establish a modern land use policy to host petroleum industrial sites taken into account, population density, urbanization, protection of natural and cultural sites, protection of agricultural land and protection of the environment.
- Infrastructures development: roads, piping, services bases, ports, medical centers, airports and heliports
- Education: the update and modernization of vocational education and establishment of research laboratories in geosciences, mathematics and chemistry.

These reforms and investments shall be carried out promptly in order to attract investors, otherwise:

- upstream companies will be forced to use facilities of other countries and to bring no Lebanese technicians to develop Lebanese gas fields
- Petrochemical investors will establish their plants in other new gas producers' countries such as Cyprus, Turkey, Greece, Croatia, ...